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CAN THE QUALITY INDEX CONCEPT BE USED IN PONDEROSA PINE AND SUGAR PINE?

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Some foresters have suggested that quality indices might be used in appraising timber and in making short-run management decisions for ponderosa and sugar pine in California. A recent study of the prices of these two species, however, indicates that quality indices will not give results that are satisfactory for these uses.

A quality index is a single numerical figure for expressing comparative quality. The concept has been thoroughly studied and applied in the eastern hardwoods[1/] and in the southern pines.[2/] The quality index is the sum of each lumber grade yield times its grade-price ratio. The grade-price ratio is the ratio of the price of that grade to the price of some base grade.

The quality index idea will work if two conditions are met:

(1) Logs or trees of similar lumber grade yields can be satisfactorily segregated by a log or tree grading system.

(2) The price ratios used meet certain general requirements.

In this report we are concerned only with the second criterion--what these general price ratio requirements are and whether ponderosa and sugar pine lumber price ratios in California can be expected to meet these requirements.

1/ Beasley, Ronald I., and A. M. Herrick, Lumber Price Relatives: their application in the Hardwood Quality Index. Purdue Ag. Exp. Station, Bulletin 610, Lafayette. 30 pp., October 1954.

2/ McClay, T. A. Lumber Grade yields in the loblolly-shortleaf pine type by the southern pine log grades. Southeastern Forest Exp. Station, Paper 37, 12 pp. April 1954.

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The requirements we place on the price ratios must be in keeping with the way we expect to use the quality index. The major jobs in which a quality index would help are appraising timber and making short-run timber management decisions. Both of these jobs involve relatively short periods of time, generally less than 10 years. Our best performance in these jobs is obtained when we use current or recent past information. The use of average price ratios does not eliminate the need for keeping abreast of lumber market conditions. If the price ratios are valid they simply make it possible to determine the prices of all the grades of lumber at any instant of time by finding or estimating only the price of the base grade.

Therefore, the requirements we must place on the price ratios are:

(1) That they remain relatively constant even though changes occur in the market prices of all the lumber grades.

(2) That they can be accurately estimated by an average computed from a period of recent past years.

The data and the assumptions

In this study, ponderosa and sugar pine price ratios in California were tested against these two requirements. The price data used was that which has been used by the Forest Service in making appraisals.3/ Before testing these data we had to decide what base lumber grade we should use, and what base period of years.

Number 3 Common lumber was chosen as the best base grade for the ratios. It is not only the most important grade on the basis of volume and total value, but has long been a staple item in the softwood lumber market. Another possible base price was an average price. This was not used because it was not possible to determine a weighted average for the data used in this study.

We chose to use 1947-1956 as a base period for computing the price ratios. This period includes a $25 range in base grade-price per thousand and is relatively free of the effects of wartime price administration.

3/ U. S. Forest Service, Region 5, Regional average selling prices by grade--net f.o.b. mill, lumber tally, 1945-1956, San Francisco.

The method of computing price ratios

The next step was to choose from several methods for calculating the average price ratios using a base period of years. The method to be used depends upon the character of the price relationships. It seemed valid to compute the price ratio for a grade as the slope of a regression through the origin of the price of that grade on the price of the base grade. For example, using the prices of D Select ponderosa pine lumber from 1947 to 1956 and the prices of No. 3 Common lumber for the same period, we compute $Y = 2.53X$ (fig. 1), where Y is the price of D Select and X is the price of No. 3 Common (or $Y/X = 2.53$ = a constant for all values of X.)

The method of testing the price ratios

The regression method permits us to make some statistical tests of the ratios to find out if they meet our two requirements. Let us illustrate the method of testing by using D Select prices again as an example, and start with the requirement that the ratios remain relatively constant during changes in lumber prices.

To meet this requirement, the regression of D Select prices on No. 3 Common price must go through the origin and have a slope of 2.53. We can also compute another least squares linear regression of the form $Y = a + bX$ using the same data for the 10-year period. If a is other than zero, and b is other than 2.53 in this second regression, then we must consider rejecting the price ratio for not meeting the first requirement.

How much difference is enough to lead us to reject a price ratio for a particular grade? The regression $Y = 4.21X - 123.45$ (fig. 1) is the best linear fit to the data when we do not force the line through the origin. If it is a significantly better fit than the line through the origin, $Y = 2.53X$, then we may reject the constant price ratio idea for D Select ponderosa pine. The sum of squares of deviations about the line through the origin, $Y = 2.53X$, is 5,471.66. That about the line, $Y = 4.21X - 123.45$, is 3,627.19. This reduction of 1,844.46 in the sum of squares is not significant ($F = 4.07$). Therefore we are led to believe that the regression $Y = 4.21X - 123.45$ does not necessarily give a better estimate of the price of D Select than $Y = 2.53X$. And the ratio of the two prices--D Select and No. 3 Common--($Y = 2.53X$) can be considered constant at all levels.

However, we must also consider the second requirement: that we be able to calculate the ratio with accuracy. To do this we can compute the standard error of estimate for the "best" regression, in this case $Y = 2.53X$. The standard error is $24.66 per M board feet.

It should be pointed out here that the 10 years of price data used is a time series. These statistical calculations do not take into account the possibility of serial correlation. In general, the use of time series data tends to show more correlation than would be obtained if the data were randomly collected. However, our procedure may be valid since we are considering rejecting the price ratios due to insufficient correlation.

These tests for constancy and accuracy were made for each of the select and shop grade prices of ponderosa and sugar pine, and for the common grade prices of the two species combined.

Results

If any of the grade price ratios is either not constant or not accurate enough, the price ratio system as a whole must be rejected for the species. In Table 1 a significant "F" is interpreted to indicate that the price ratio for that particular grade does not meet the "constant" requirement. The ratio for one grade--No. 3 Shop sugar pine--cannot be considered constant, at the 5 percent level of probability.

If the model of a straight line through the origin can be accepted as correct, then the standard errors which exceed $10.00 in Table 1 may be considered to be too high. There is one chance in twenty that the actual price of a grade, when No. 3 Common price is $80.00 per M, will be more than $7.70 different than that which is estimated from a regression whose standard error is $10.00. Thus we note that none of the Select or Clear grade prices of either species can be determined with sufficient accuracy on the basis of the recent past price of No. 3 Common.

Conclusions

Ponderosa pine and sugar pine price ratios in California do not meet the requirements necessary for the use of the quality index concept. Consequently the quality index cannot be used as a professional technique in the management of California pine forests and forest industries.

This means we must continue to develop a better understanding of the markets for the various lumber grades. Such an understanding will permit us to make reliable estimates of prices for the periods with which we are concerned. Market prices can then be applied directly to grade-yield percentages obtained from good log and tree grading systems to give us actual dollar and cent gross values to use in making appraisals and other management decisions.

Table 1.- Tests of significance of difference between price estimates determined by Y = bX and by Y = a + bX, where Y = desired grade price and X = No. 3 Common price

Lumber Grade	Ponderosa pine		Sugar pine	
	F [1/]	Standard error of best estimate	F [1/]	Standard error of best estimate
		Dollars		Dollars
1 & 2 Clear	2.89 NS	28.07	2.14 NS	29.10
C Select	3.03 NS	28.79	2.45 NS	28.81
D Select	4.07 NS	24.66	3.95 NS	26.49
No. 3 Clear	2.15 NS	14.09	1.77 NS	19.40
No. 1 Shop	1.57 NS	9.28	0.25 NS	9.69
No. 2 Shop	0.58 NS	8.27	0.02 NS	7.10
No. 3 Shop	0.48 NS	3.16	8.38 *	3.19
No. 1 & 2 Common [2/]	1.49 NS	2.50		
No. 4 Common [2/]	0.21 NS	2.50		
No. 5 Common [2/]	4.28 NS	6.41		

1/ NS = Non significant. Constant price ratio, Y = bX, is accepted.
* = Significant at 5% level. Constant price ratio, Y = bX, is rejected.

2/ Data for these grades are prices of the two species combined.

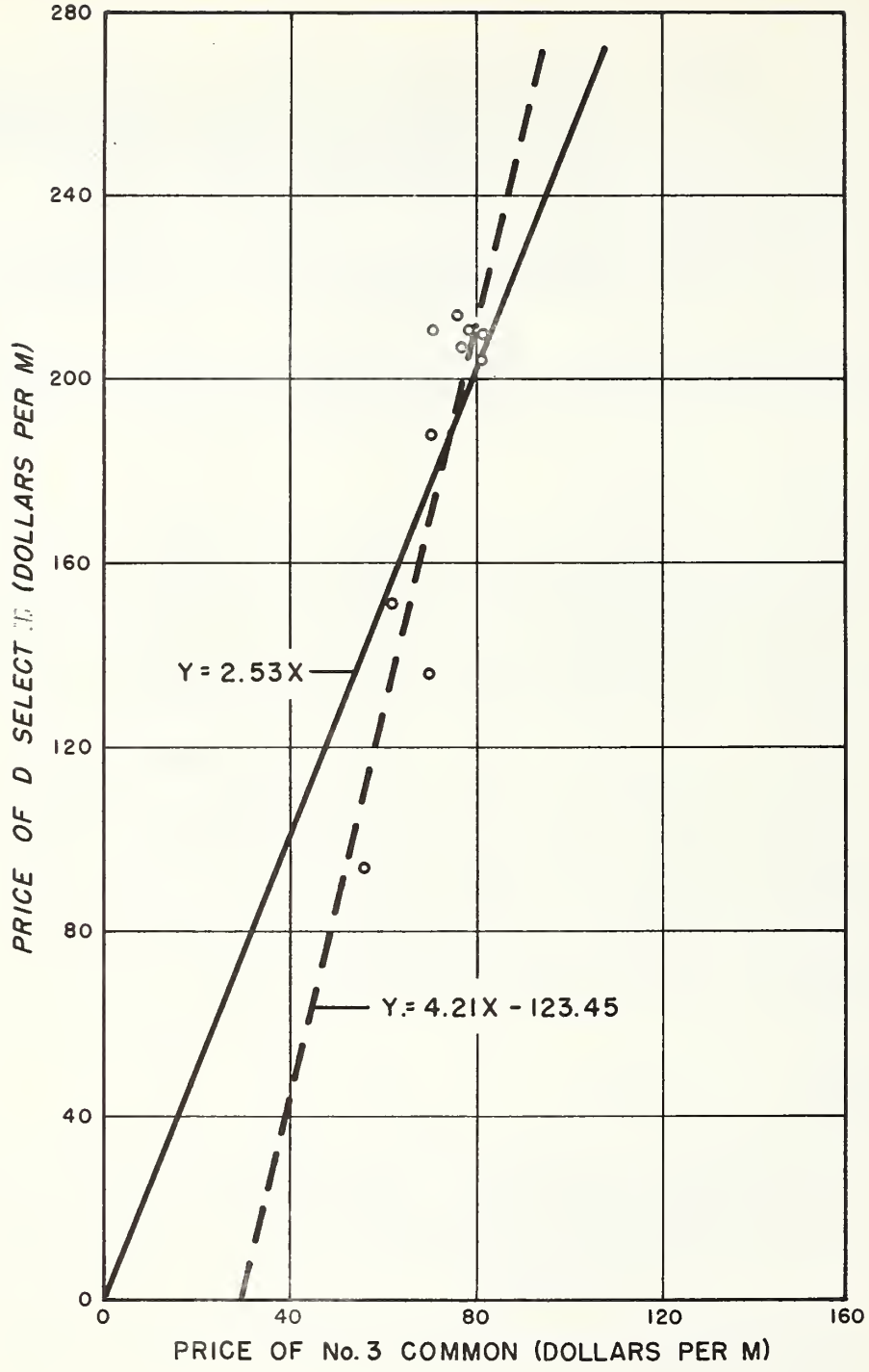

Figure 1.- Two expressions of the relation of D Select to No. 3 Common Ponderosa Pine lumber grade prices.